VOL. 4 No. 1 JANUARY 1927

The AMERICAN JOURNAL of OPTOMETRY

JAN 11 1927 LIBRARY

INCORPORATING

THE NORTHWEST JOURNAL OF OPTOMETRY

EDITORIAL STAFF

CAREL C. KOCH
Editor

E. O. FJELSTAD J. I. KURTZ

STATE EDITORS

E. B. ALEXANDER
A. S. ANDERSON
J. F. ANDREAE
L. P. FOLSOM
D. A. KINNEY
J. A. LARGE
M. B. MEYER
C. A. PERRIGO

COLLABORATORS

G. H. Aronsfeld, *Galveston;* F. P. Barr, *Rochester;* B. G. Bauman, *Alliance;* P. J. Beyhan, *Santa Barbara;* H. P. Blaine, *Norfolk;* H. M. Block, *Waco;* W. I. Brown, *New Bedford;* A. H. Bush, *Rochester;* C. P. Cleaves, *Center Harbor;* R. L. Coffin, *Baltimore;* R. G. Colberg, *Aberdeen;* E. J. Deane, *Bloomsburg;* L. L. DeMars, *Minneapolis;* G. L. DuPlessis, *Portland;* E. K. Eliason, *Duluth;* W. S. Farmer, *Oklahoma City;* J. A. Haustein, *Red Wing;* A. B. Howard, *Ware;* W. B. Lyon, *Albert Lea;* O. L. McCulloch, *Holyoke;* F. McFadden, *Athol;* E. Marcus, *Minneapolis;* W. H. Nordin, *Faribault;* A. Nordstrom, *Minneapolis;* J. W. Parker, *Kansas City;* R. M. Peckham, *Waterbury;* J. E. Peterson, *Minneapolis;* J. H. Petty, *Jackson;* M. O. Ranoe, *Minneapolis;* C. I. Saks, *Syracuse;* A. M. Skeffington, *Kearney;* W. Smith, *Roxbury;* W. W. Smith, *Dublin (Ga.);* M. Steinfeld, *Paducah;* E. G. Wiseman, *Buffalo.*

Published Monthly by the Delaware, Iowa, Maryland, Minnesota, Nebraska, North Dakota, Oklahoma and Vermont Optometric Associations at 209 Yeates Bldg., Minneapolis, Minnesota

Entered as second-class matter February 20, 1924, at the postoffice at Minneapolis, Minnesota, under the Act of March 3, 1879.

PRINCETON

No. 970 Flextip Temples

COMBINE

the Convenience of Eyeglasses

and

the Security of Spectacles

The shorter length of these temples allows the spectacles to be put on or taken off without removing the hat or disarranging the hair—a feature which will be appreciated by patients who wear spectacles only part of the time.

Ample holding power is provided by means of the adjustable tip which also assures comfortable wear.

BAY STATE OPTICAL CO.

ATTLEBORO . . MASS.

CHICAGO SAN FRANCISCO

AMERICAN JOURNAL OF OPTOMETRY

Vol. 4 JANUARY, 1927 No. 1

CONTENTS

Original Papers

The Pathologic Action of Light on the Crystalline Lens. W. Stewart Duke-Elder..... 6
The Therapeutic Value of Glasses. J. W. Parker..... 13
Is Vision Electrical or Chemical? Jno. H. Petty..... 14
Optometric Facts for Ophthalmologists Consideration. J. I. Kurtz.. 16

Optometric Notes

Interpupillary Gauge. E. O. Fjelstad..... 19
The-Odor-Ah! Charles P. Cleaves..... 20

Abstract Department

Modifications of Relief Produced by Decentrations in Binocular Vision. Dupuy-Dutemps 20
A Stereoscopic Phenomenon 21
Monocular Malingering Test. E. H. Schild..... 21
Measuring the Abnormalities of the Fundus. P. Bretagne..... 21

Editorials

Licensing Automobile Drivers..... 22
On Dispensing 23

Correspondence

J. I. Pascal..... 23

Special Reports

The Problems of Optometry. William Smith..... 24

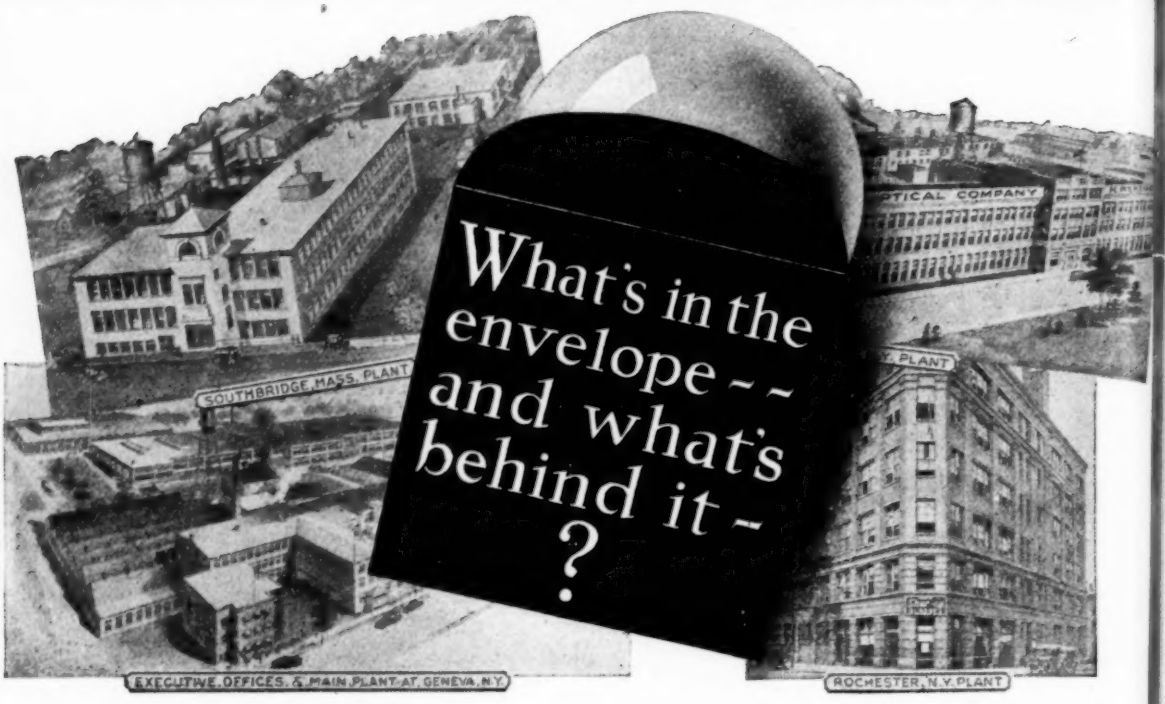
Reports and Announcements of Societies

The Minnesota Convention 26
The Oklahoma Association 26
The Skeffington Clinics and Lecture Classes..... 26

494945

MAR 15 '31 U OF M BINDERY

SHUR-ON LENSES


What's in the envelope - - and what's behind it - ?
SOUTHBRIDGE MASS. PLANT
EXECUTIVE OFFICES & MAIN PLANT AT GENEVA, N.Y.
ROCHESTER, N.Y. PLANT

Apparently just a simple piece of glass - - but behind it are the resources of these four factories

FACTORIES—buildings with great investments in machinery, material and men grow only in the field of public acceptance. This field is not fertile and produces only when assiduously cultivated and nourished with value and service.

The four factories of the Shur-on Standard Optical Company, Inc. evidence the dependability and quality many have found in its products.

It is this dependability and quality which have developed the confidence enjoyed by Shur-on lenses and built for their production some of the world's great lens plants.

Specify Shur-on Lenses.

SHUR-ON STANDARD OPTICAL CO., INC.
GEVEVA, NEW YORK, U. S. A.

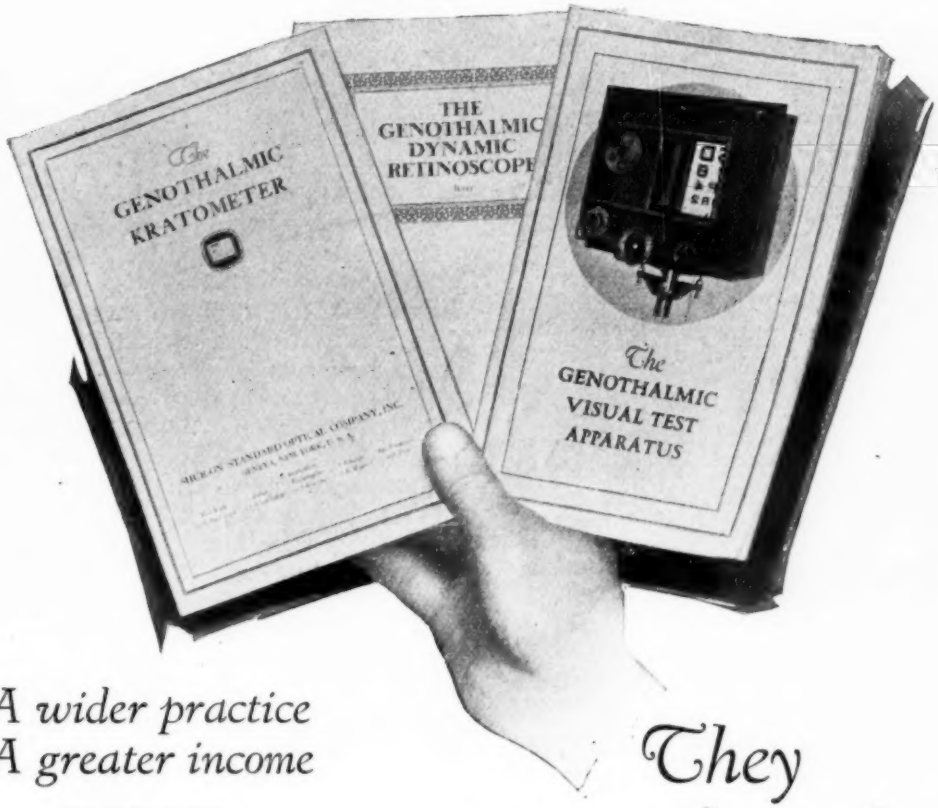
NEW YORK, 1112 PERSHING SQUARE BLDG. CHICAGO, 5 SOUTH WABASH AVE.
PHILADELPHIA, 1211 CHESTNUT STREET SAN FRANCISCO, 278 POST STREET
BOSTON, 333 WASHINGTON ST.

Factories at GENEVA, N. Y., MOUNT VERNON, N. Y., ROCHESTER, N. Y., SOUTHBRIDGE, MASS.

Optical Shur-on Products
Quality beyond question for more than fifty years

MEMBERS: Co-operate With Your Advertisers

There are IDEAS *in these books*



A wider practice
A greater income

PRESTIGE
PRIDE
SATISFACTION

THESE are the things many men have secured through Genothalmic Instrumentation. These instruments have opened the way to professional achievement and the rich rewards which follow prestige and authority.

YOU HAVE
THE SAME OPPORTUNITY
SEND FOR
THESE BOOKS TODAY

They are worth reading

SEND
FOR YOUR
COPIES
TODAY

SHUR-ON STANDARD OPT. CO., Inc
GENEVA, N. Y.

Gentlemen:
Please send me by return mail, free of charge the books I have checked below:

- ☐ VISUAL TEST APPARATUS
- ☐ KRATOMETER
- ☐ DYNAMIC RETINOSCOPE

Name_____

Address_____

_____

Say: I saw it in the American Journal of Optometry

AMERICAN JOURNAL OF OPTOMETRY

Vol. 4 JANUARY, 1927 No. 1

THE PATHOLOGIC ACTION OF LIGHT ON THE CRYSTALLINE LENS*

W. Stewart Duke-Elder, B. Sc., M. D., F. R. C. P.

London, England

The Experimental Production of Cataract

(1) *Long Wave-lengths.*—Cataract due to electrical oscillation has been produced in animals by Hess (1888) and Kiribuchi (1900), using the discharge from a Leyden jar. The electric effect is very probably complicated by concussion effects, whose influence in the coagulation of proteins has already been referred to (mechanical shock and agitation).

(2) *Infra-red Waves.*—Isolated heat rays readily produce a lenticular opacity, a result which has been obtained by several experimenters — Richen (1913), Vogt (1918), Grinelle (1924), Muller (1924), Kranz (1925). Using concentrated light from a carbon arc, the writer, in conjunction with Leonard Hill, has produced an opaque disc-like opacity on the anterior surface of the lens in five minutes in rabbits; with less intense exposures a diffuse opacity occurs throughout the lens; with still less a posterior opacity develops after some days.

(3) *Visible Rays.*—Opacity has been produced by visible light (concentrated sunlight with the infra-red and ultra-violet sunlight with the infra-red and ultra-violet excluded) by Werneck (1834), Czerny (1867), Deutschmann (1882), Langenbeck (1903), and Herzog (1904).

(4) *Ultra-violet Rays.*—Under experimental conditions opacity is difficult to obtain owing to the difficulty of getting a sufficient amount of short-waved radiation through the anterior eye; further, the lens proteins appear to be more stable under these radiations than most others. Several observers have, therefore, reported negative results. Using intense radiation, it has, however, been produced by Widmark (1898) to a marked degree and by Verhoeff and Bell (1916) to a slight degree. The latter observers, moreover, showed that when a lens thus exposed remained clinically transparent, on keeping it for 48 hours in normal saline a definite haze developed confined to the pupillary area. The isolated lens also, on exposure to ultra-violet, if suspended in physiological saline, turns similarly opaque (Chalupecky, 1913; Soret, 1893), an observation confirmed by the writer; the opacity is a faint hazy one, which, on keeping in saline, develops much more intensely than unradiated controls. While complete precipitation is thus obtained only with difficulty, the work of Burge (1916) and Adams (1925) already mentioned shows that the first stages of the process are readily inaugurated. The most innocuous spectral region would appear to be the border-line between the visibles and the ultra-violet (Trumpy, 1925), since here both thermic and abiotic effects are at a minimum.

(5) *Short Wave-lengths.*—Radium has been found to procure cataract experimentally in animals (Birch-Hirschfeld, 1904-08; Alphonse, 1909), in the foetus in utero (Hippel, 1907), and clinically in man (Salus, 1925; Ascher, 1925; and others); while X-rays have the same action, as has been demonstrated by experiments in animals (Birch-Hirschfeld, 1904; Tribondeau and Belley, 1907), in the foetus (Stock, 1907; Herzan, 1907), and has been reported as occurring clinically after intensive therapeutic doses (Pa-

*From the National Institute of Medical Research and the Ultra-Violet Clinic, Royal London Hospital. Reprinted from the **Eye, Ear, Nose and Throat Monthly,** September, 1926. The first portion of this paper appeared in the December issue of this Journal under the title **The Pathological Action of Light Upon the Retina.**

ton, 1909; Williams, 1920, and others).

(6) *Sensitizers.*—Sensitizers act in vivo in the same way as they do in a photographic plate; they so modify the substance with which they become associated that it reacts photochemically to long wave-lengths which ordinarily would produce an inappreciable effect. Thus when an animal is injected with haematoporphyrin visible rays produce the same effects as ultra-violet, and, while remaining normal if kept in the dark, if it is placed in sunlight the animal dies in a few hours. Howell (1924) has recorded the formation of cataract in animals so sensitized and exposed to daylight. Apparently, therefore, lenticular opacity can be formed by the action of visible light on sensitized protein. If this finding is substantiated it forms a powerful argument in favor of the possibility of the occurrence of the same reaction, though more slowly, by ultra-violet light. It is indeed possible that a process of continuous photosensitization may play a part in the production of cataract clinically.

(7) *Salt Concentration and Osmosis.*—Heubel showed (1880) that the injection of hypotonic solutions into the eye made the lens opaque, and that similar intravenous injections produced a like result; further, in frogs, if the injection be pushed rapidly, that the lens remains clear, then, if the animal is immersed in water, opacity quickly develops. It therefore appears to occur on osmotic dilution, and not on concentration—an inflow of water into the lens. The opposite process of concentration of the aqueous, which was the original theory of the aetiology of cataract advanced by Panas (1894) and accepted by Leber (1903), is unrealizable in effective degree in vivo.

The Clinical Occurrence of Cataract

(1) *Cataract Due to Electricity; Electric Cataract; Lightning Cataract.*—It has long been recognized that cataract can readily follow the actual passage of an electric current through or near the eye. The photophthalmic symptoms and the heat effects on the surface which follow exposure to the short-circuiting of a high-tension current, or a lightning flash, have been dealt with in the previous article, but although the infra-red and ultra-violet rays are present in quantity, it is beyond doubt that the formation of cataract is largely due to electro-chemical action, to which must be added concussion effects.

(2) *Cataract Due (probably largely) to Heat; Occupational Cataract.*—Wenzel (1808) was the first to note that "les personnes, qui approchent beaucoup le feu, epreuvent un dessechement et une opacite de la cristalline." Since then a very large amount of speculation has centered round the fact that in certain industries where the workmen are exposed to high degrees of heat the occurrence of cataract has been found to be prevalent. Meyhofer (1888) first directed attention to this in glass-blowers, and, although some have questioned it, its prevalence and its right to be considered as an occupational disease was established by Legge in a Home Office report (1907). While by no means always so, the lesion is usually a typical well-defined disc-like opacity situated in the posterior pole of the lens (Parsons, 1913). A somewhat similar condition has been noted in iron workers (Criland, 1913), tin workers (Healy, 1921), chain workers (Roberts, 1921), and gold smelters (Brinton, 1913).

The emission spectrum from molten glass was examined by Crookes (1914), who found that in the ultra-violet it extended down only to 3340 A.U. on prolonged exposures, while the rays in the short infra-red were extremely powerful; he therefore concluded that the ultra-violet were to be exonerated and that the condition was due to heat waves. Schanz and Stockhausen (1910), however, found that, although the spectrum did not extend far into the ultra-violet, yet the short waves were present in high intensity; probably the spectrum varies with the metals used. Moreover, when we consider that the lens absorbs rays up to 4000, that the exposure lasts with intermissions for years, and that the worker, bending over a tank, looks at a source of maximum extensity involving a high energy concentration in the lens, it would seem unsafe to conclude that the mischief is entirely due to infra-red. Further, the fact that workers

in some of the other trades mentioned where ultra-violet is absent seem to be affected less frequently points to the probability that while heat is apparently the main factor the long ultra-violet may also have a not inconsiderable effect. The theory at present generally accepted is that suggested by Parsons (1913) and supported by Hartridge and Hill (1916), that the main factor in the aetiology is malnutrition or irregularly varying nutrition due to changes in the composition of the aqueous or to the liberation of toxins by the action of heat waves falling on the iris and ciliary body. The cataract is, therefore, either a complicated cataract consequent on a chronic, mild inflammation of the ciliary body, or a degenerative change induced by periodic variations in the nutrition of the lens. The only evidence of such a mild iridic involvement that has ever been brought forward is the demonstration of haemolysins in the aqueous after raying, which, according to Romer (1903), occurs only in iritis and after paracentesis. Romer's statement is, however, wrong, for more recent and refined methods have demonstrated the presence of haemolysins in the normal aqueous of highly immunized animals in small amounts. The action of heat rays is non-specific; in the present case, as always, the initial action is to dilate the capillaries, its subsequent action to induce congestion, stasis, haemorrhages, and perivascular leucocytic infiltration; there is no evidence of a specific iritis, and no toxin will presumably be liberated until, as in other parts of the body, the lesion is pushed to the extremity of an actual burn involving tissue destruction—an unlikely event under the circumstances, even allowing for the absorption by the pigment. When the capillaries are dilated their permeability is increased, and substances of colloid aggregation are allowed through their walls in larger quantity than normally. Thus albumin, globulin, and fibrin appear in the aqueous, which may, therefore, coagulate and give the appearance of a fibrinous exudate. Haemolysin is, or behaves as if it were, a colloid (Bechold, 1907; Eisler, 1923), related to, or associated with, globulin (Homer, 1920; Ruppell, 1923); its presence in the aqueous in quantity is merely an index of capillary dilatation by any agency whatever. Clinically, there is no evidence of any pathological change in the iris of the men affected. The fact that the opacity is a posterial polar one has been cited as analogous to a complicated cataract following a chronic cyclitis; its occurrence here can amply be accounted for by the concentration of radiant energy by refraction through the cornea and the lens, by reflection from the posterior surface of the lens, by the absence of convection currents in this region, and by the large accumulation of radiant energy here when emitted from a source subtending a large solid angle. In any case, the comparison is an extremely superficial one depending merely upon site, for the intimate structure of glassblowers' cataract as revealed by the slit-lamp is widely different from that of complicated cataract (Schnyder, 1926).

A toxic origin being unlikely, we are left with a physiological change: malnutrition due to changes in the aqueous. A considerable amount of recent evidence and as yet unpublished and uncompleted researches by the writer are tending to show that in all probability the aqueous is within biological limits a dialysate of the blood-serum, virtually stagnant, with only a minimal circulation due to transudation and osmosis through the capillaries and to pressure changes induced by muscle movements. Apart from its being highly oxygenated, it probably plays the part only of a vehicle in the nutrition of the lens, whose metabolism is presumably regulated in very large measure by the efficiency of its own autoxidation system. If this is the case, the only change that capillary dilatation will bring about will be the alteration of its colloid-crystalloid content in accordance with the requirements of a Donnan's equilibrium—i. e., an increase in the colloid content and a decrease in the crystalloids, with a total very slight increase in osmotic pressure. This will have a minimal effect on the nutrition of the lens, and any effect the small osmotic variation will have on the fluid traffic of the latter will be a tendency for water to flow out of it, an effect the reverse of that required to induce opacity.

In contradistinction to this, cataract is readily produced by heat; the short time interval we have seen from a consideration of the chemistry of the changes is no objection to the two conditions being similar in nature, while it throws out of court any indirect action through the ciliary body. This is further emphasized by the fact that opacity can be produced in the same way in albino rabbits (Vogt, 1925) where there is no pigment in the iris to absorb large quantities of heat. Further, in Italian glass workers, who work very near to the furnace, corneal opacity is common (Critchett, 1913); it seems only reasonable to attribute the same effect to the same cause, and this is obviously the direct result of the incident radiant energy. The fact that the cornea does not always turn opaque before or with the lens is explained by the greater concentration of energy in the latter when the radiating source subtends a large solid angle; in the case of a small source, as is used experimentally, it frequently does become opaque first. Further, physiological repair of submaximal damage is much less evident in the lens, and the cornea is more able to cope successfully with a noxious agent acting over a long period of time. At the same time, however, while the direct action of the incident energy upon the lens itself probably is the fundamental factor in the aetiology, the other is almost certainly of importance secondarily in bringing about the conditions necessary for the flocculation of the proteins already rendered labile by the denaturing action of heat and light; and the increased "permeability" of the capsule which will probably follow exposure will further assist in allowing abnormal fluid traffic.

(3) *Cataract Due (probably largely) to Long Ultra-violet Light. Senile Cataract.*—There is a large amount of evidence which may be brought forward to correlate the incidence of senile cataract with the radiant energy from the sun, and to assume with Hertel and Henker (1910) that it is axiomatic that daylight by a process of adaptation has become innocuous, is probably too sanguine, and certainly unscientific. It seems beyond doubt that cataract is more common in India than it is in Europe, and statistics show that it matures earlier—20 years (Hirschberg, 1898), 10 years (Snell, 1907), while the frequent occurrence of black pigmentation due to melanin in the lenses of natives which are otherwise clear has already been mentioned, and its significance as indicating a first stage in the development of opacity has been indicated. According to Walter (1919) the same thing holds in America, cataract becoming more common as we approach the equator. Daland (1917) remarks upon its frequency in the Arctic regions, where the sunlight is especially rich in ultra-violet, which is reflected from the surface of the snow with dazzling brilliancy. Schwitzer (1895), Grosz (1895), and Hirschberg (1898), comparing workers in the fields with those living in the towns in Germany and Austria, found the incidence of cataract much greater in the former who are exposed all day to the sun. Further, Ascher (1917), over a series of uniocular cases found industrially, states that the side of incidence can be traced definitely to the side of constant brilliant illumination while at work; while with even more refinement of localization, Handman (1909) states that 81 per cent and Greene (1908) that 95 per cent of Indian cataracts commence in the lower quadrant of the lens, where the incident light falls more directly.

The radiation from the sun may be taken as that of a black-hot body at 5000° C. absolute; its spectrum ranges from the infra-red down to 2910 A.U. under the most favorable conditions (Cornu, 1878), the maximum energy density being about the blue-green, 4700—5000 A.U. (Abbott, 1906). The infra-red forms only a small portion of the energy output, and the greater part of it is absorbed by the water vapor of the atmosphere, which may be taken to average a layer of water 1.5 mm. thick; of those which are left the lens absorbs only 3.8 per cent (Luckiesh, 1913), the main bulk passing to the retina. Any thermal effect, therefore, will be associated with the visible rays rather than the infra-red, and in the lens with its high transparency to these wave-lengths their effect must be small. On the other hand, there will be a large energy absorp-

tion in the lower visibles and long ultra-violet between 4000 A.U. and 3000, especially in the adult and senile lens, and this energy is potentially capable of inducing pathological change. No distinction can be drawn between the effect of the infra-red, the visibles, and the longer ultra-violet on the ground of heat radiation, and all attempts at differentiating their action in this sense is scientifically unsound. Abiotic action for the usual intensities ends at the upper limit of about 3100 A.U.; Coblentz and Fulton (1925) state that it may, under favorable conditions, be attained up to 3600; all appreciable action above that is thermic in nature. The large portion of the solar energy absorbed by the lens can, therefore, produce both thermic and abiotic effects.

It is highly improbable that the solar energy induces direct coagulation. The changes are almost certainly of the much more subtle nature we have already discussed—a diminution of the glutathione content lessening very gradually the efficiency of the autoxidation system, and a change of the proteins into a more labile state so that they are more easily coagulated by other factors. Sooner or later the actual occurrence of cataract is determined by changes in hydrogen-ion concentration, in salt content, in osmotic conditions, or in nutritional disturbances.

The objection that has always been raised to the theory of the direct action of sunlight is that in 93 per cent of cases (Magnus, 1890) senile cataract begins in the periphery where the lens is protected by the iris, and not in the pupillary aperture where the light falls. Apart from the fact that a predilection to the inferior segment has been recognized, this criticism is readily answered. In a slow process of the nature we are considering (diminution of glutathione, etc.) the action will tend to be felt uniformly throughout the lens; further, the greater portion of the shorter waves which are dispersed are reflected at right angles, and will thus affect the periphery towards which they will be concentrated by internal reflection, and where many of them will be absorbed. In this region are situated the younger and more actively growing fibres which will call for the highest efficiency of the autoxidation system to maintain their more active metabolism. These will, therefore, be the first to be affected by its deterioration. At the periphery, moreover, it has been shown by the injection of dyes that most of the fluid interchange into the lens occurs, and the effects of any change in the nature of the ocular fluids will therefore be first seen here.

The hypothesis was first advanced by Peters (1900) that senile cataract was due to disturbed nutrition owing to pathological change in the ciliary epithelium. Van der Hoeve suggested in 1912 and later (1918) elaborated the theory that the light, which was dispersed in its passage through the lens, on falling upon the ciliary body, would cause minute damage of such a nature that could not be detected clinically or microscopically, and that this would result in impaired nutrition and consequent degeneration of the lens. It is difficult, however, to believe that the ciliary body of all cataractous persons is diseased, and, moreover, the same arguments apply to the present case as we have considered in the discussion of occupational cataract. In addition, the factor of physiological repair to slight damage in a tissue with the metabolic activity of the ciliary body must be taken into account. The fact that 65 per cent of persons between 51 and 60 years (Horlacher, 1918) and 96 per cent of those above 60 (Barth, 1914) have lenticular opacities detectable by the slit-lamp would seem to be more probably explained by the known and experimentally proved action of radiant energy on the autoxidation system of the lens and the stability of its colloid system.

(4) *Cataract Due to Very Short Wave-lengths.* — The occurrence of cataract due to gamma rays is rare, presumably owing to the rarity of sufficient exposures. Ascher (1925) and Salus (1925) report several cases where treatment was given for eye diseases by the prolonged application of radium. The opacity usually develops some time later in the posterior cortex. Opacity of the cornea occurs as well. Williams (1920) reports a case where the evidence points to a

cataract developing bilaterally in a woman of 40 years as being due to a course of 60 treatments of X-rays to her face.

(5) *Other Forms of Cataract; Diabetic Cataract.*—Two conditions are met with in diabetes; in the first place senile cataract is comparatively common and appears at a relatively early age, while in the second a characteristic form of cataract peculiar to the disease occurs, although with much greater rarity. The differential diagnosis can best be made by the slit-lamp, and on its basis Schnyder (1923) found one case of true diabetic cataract in 59 cases of senile cataract occurring in diabetic subjects. The main factor which, in all probability, determines the high incidence and early occurrence of senile cataract is the fact already considered that both sugar and acetone in small quantities sensitize proteins, including the lens proteins, to the denaturing action of light, while, in addition to this, the diabetic state, by subjecting the lens to an osmotic deforming force and abnormal fluid traffic, induces the condition still more readily, accelerates its rate of development, and tends to alter its type. True diabetic cataract is largely determined by the latter factor.

The writer (1925) has already suggested that in the rising sugar concentration of diabetes, provided the available water reserve is maintained, the osmotic pressure of the aqueous tends to decrease; fluid therefore tends to flow in to the lens. If the process is a relatively mild one the lens swells and is deformed, its curvature and refractive power are increased, and the eye tends to become myopic; if, however, the change is greater and the inflow of fluid more rapid, actual droplets are formed under the capsule, and the transparency of the lens is impaired by the irregular dispersion of light at the interfaces between the two media of different refractive indices—aqueous and lens fibres. These fluid vacuoles have been noted in cases of acute diabetic myopia by Lundsgaard (1910) and Strickler (1911), and they are readily seen in cases of typical diabetic cataract (Schnyder). A "cataract" is thus formed with great rapidity. Conversely, with a fall in sugar concentration, a reverse osmotic flow is set up, fluid flows out of the lens, and in the first case the eye becomes of normal or hypermetropic refraction; in the second, provided further organic changes have not taken place, the fluid droplets will disappear, and the cataract clears up, as has been observed in diabetes by Nettleship (1885), Nicholson (1923), Joslin (1924), and Fischer (1924). This abnormal fluid traffic and the formation of actual droplets between the lens fibres will in time induce actual opacity of the latter, a process no doubt largely aided in part by the actual strain of mechanical deformation tending to protein denaturation (a seemingly slight force, but at the same time possibly comparable to the coagulation occurring on the surface of a soap bubble or between the phases of two immiscible fluids), in part by changes in the hydrogen concentration and salt content, and in part by the upset of the autoxidation system. This last might well affect the soluble beta-krystalline and the glutathione, which, being diffusible, might be carried away through the capsule whose "permeability" is almost certain to suffer in the general malnutrition that accompanies diabetes.

A peculiarly oedematous state of the ciliary epithelium in diabetes has been described by Kamocki (1887) and corroborated by Zentmayer (1913), which being peculiar to this disease, was attributed by its discoverer to a specific "cytotoxin"—an explanation hitherto accepted—and was supposed to be a casual agent in the incidence of diabetic cataract, acting, as the infra-red rays were said to act in occupational cataract, by inducing lenticular malnutrition indirectly through changes in the aqueous. Since, however, all signs of inflammation are absent and the appearances described are evidently passive, the more likely explanation would appear to be that they are osmotic in origin —a purely physical process of oedema, running parallel with, and having no causal relation to, similar processes occurring in the lens itself.

The clinical characteristics of this form of cataract indicate the importance of this osmotic process in its ori-

gin. It always occurs when the sugar concentration is high, and usually when the patient is fairly well—i. e., when he has sufficient fluid reserve. It is practically always bilateral (54 out of 56 cases, Zeller, 1899), and the change starts immediately under the capsule. It frequently occurs in young subjects—11 months (Major and Curran, 1925); 5 years (Frey, 1887), 7 years (Schnyder, 1923); it comes on rapidly and matures quickly, often in a few days—4 days (Scheffels, 1898), 11 days (Neubergers, 1893)—and it seldom requires more than a few weeks. With the slit-lamp the symmetrical opacity in the subcapsular region is in the early stage seen to be made up of discrete drops of fluid of diameter 0.04 to 0.1 mm. (Schnyder, 1923), larger at the anterior pole, often confluent at the posterior, while the more superficial lens fibres are separated by larger spindle-shaped fluid lacunae.

The *Cataract of Cholera* is probably to be associated with a similar process. It is said to be due to the abstraction of water from the lens due to the general dehydration (Fuchs), but the opposite process, as in other forms of cataract, is probably at work. In this disease the bowel mucosa is disorganized and allows the passage of material from the blood in the order, first, water and salts, later, organic substances and proteins. This preferential early loss of the dialysable and osmotically active constituents, while rendering the blood more viscous, will make it in the osmotic sense more dilute, and if the fluid volume is at all kept up, water will tend to flow into the lens, inducing opacity as in diabetes.

Complicated Cataract.—The determining factors in the formation of complicated cataract are probably malnutrition and the influence of toxins, acting directly on the lens substance, or indirectly by altering the permeability of the capsule. It occurs typically in chronic, slow inflammations, and its localization to the posterior cortex in the majority of cases is to be correlated with the fact that here the capsule, being thinnest (Ulrich, 1898), permits of diffusion more readily than elsewhere, and that here the membrane surrounding the vitreous is firmly attached to it; a slow degenerative change will involve shrinkage both of the lens and of the vitreous, and thus, subjected to the double pull of two shrinking bodies at this point, disorganization will be hastened by the separation of the fibres and detachment of the capsule allowing the ready accumulation of fluid. Moreover, in the supply of toxic materials, the central hyaloid lymph tract may exert a localizing influence (Healy, 1921). The work of Burge (1916), showing the marked influence of calcium salts in the coagulation of lens proteins by ultra-violet light is to be associated with the occurrence of cataract in conditions as tetany, myotonia, and aparathyroidea, whether induced experimentally (Hiroishi, 1924) or met with clinically.

Anterior polar cataract, due to approximation of the cornea to the lens capsule, and posterior polar cataract, due to persistence of the hyaloid artery, are not to be considered in the same category. Neither is lamellar cataract, wherein the opacity is due to a number of globule-like vacuoles which are the remains of degenerated or undeveloped fibre cells, a developmental change which is to be correlated with similar hypoplastic changes in the teeth and the skeletal and cutaneous tissues, the result of a general constitutional disturbance.

Conclusion

The thesis advanced, therefore, is that the primary cause of cataract generally is probably to be associated with the direct action of incident radiant energy of any wave-length on the lens, increasing the lability of its colloidal system and deranging the autoxidation system upon which its metabolism depends. This renders its proteins more prone to coagulation by changes in the hydrogen-ion concentration (which also affects the autoxidation system directly), changes in the salt content, osmotic changes determined locally by the action of radiant energy on the lens capsule or by general metabolic disturbances, and by possible continuous photosensitization. To these must be added the influence of more subtle factors inseparable from the economy of so complex a physico-chemical mechanism as is living matter; but in the present state of our knowledge it seems most prof-

itable and fertile to try to elucidate these processes by reducing them as far as is possible to the known laws of chemistry and physics, instead of taking refuge behind these meaningless terms so frequently used in pathological thought—malnutrition, degeneration, and toxic action.

THE THERAPEUTIC VALUE OF GLASSES

J. W. Parker, Opt. D.
Kansas City, Mo.

Years of observation have forced the writer to the conclusion that refractionists, as a class, both medical and non-medical, have failed to fully realize the therapeutic value of lenses. True, most of us agree on eyestrain as being a common cause of headaches, nervousness, dizziness, etc. We have been made to do so because the proofs are a matter of daily occurence. I recently read a quotation which ran something like this: "Through the accumulation of facts we acquire knowledge. Through the coordination of facts we acquire wisdom." It might also be said that, through the coordination of cause and effect we learn diagnosis. If we place a pair of strong lenses or prisms on a patient unaccustomed to them, we may, even though they are indicated, bring on nausea. Where the manifestation so closely follows the stimuli we cannot fail to get the connection—neither can the patient. A stimulus of milder degree but of longer duration may bring on a more serious condition but here we often see only the manifestation and overlook the cause.

Diseases are classed as functional or organic. Functional when the symptoms are due to a perverted supply of nerve force. Organic when the tissues or organs involved begin to undergo a degenerative change. Organic diseases, even those due to germs, find little hospitality in the systems of those in whom there are no functional derangements. They find their welcome in the systems of those having a lowered vitality or power of resistance and this condition is usaully due to an inharmonious supply of nerve force.

Functional disturbance may be brought on in a number of ways.

1st. Through some organ, of which the hyperopic eye is an example, requiring more than its share of nerve force.

2nd. Through some form of pain or irritation, which through a reflex action, may cause a very intermittent distribution of nerve force to all parts of the body or, as often happens, only one or two organs are affected. A common form of such irritation is that due to low degrees of astigmatism which cause an almost constant itching or burning sensation of the eyes and lids. Not with all astigmatics, of course, but in a large percentage.

3rd. A general derangement of nerve supply may be due to wrong mental conditions, such as worry, envy, jealousy, etc. These cases may parallel that of the hyperope in which the excessive amount of energy consumed brings on a general feeling of exhaustion or, the effects may be more like those produced by physical irritation in which the symptoms are often described under the general term "nervousness."

Eyestrain is not only a common cause or aggravating factor in constitutional troubles—it is the most common cause of eye diseases. This fact should be patent to any refractionist who has developed his powers of observation, and yet, with one exception, the text books have little or nothing to say on this subject. The exception is: "The Diagnosis of Ocular Diseases," by Dr. Thos. C. Atkinson. The doctor devotes a whole chapter to this subject and deserves great credit for having written a book in which it soon becomes evident he has tried, successfully, to impart some valuable infor-

mation instead of airing a voluminous vocabulary in a collection platitudes.

Dr. Geo. M. Gould, who lived twenty-five years ahead of his time, and who might or might not have been an extremist, seems to have been the first man of note who realized the amount of harm being done by neglected refractive errors. What we need today is a similar writer who could and would arouse the interest of the general practitioner. Millions of people suffering from ocular defects, and not being able to interpret their symptoms, naturally consult the family physician. He, having neither the training nor facilities for making an ocular examination is apt to take the path of least resistance and treat the symptoms. The writer has long contended that every physician should be equipped with an inexpensive outfit and the necessary training to enable him to differentiate between the emmetropic and ametropic eye. Were he able to do this, even though he was incapable of making a thorough refractive test, he would be in a position to render a higher service to his patients and more than likely the added prestige and good will obtained would more than offset the lessened prescribing of bromides and coal tar derivatives. In fact it seems to the writer that the quickest way to educate the public along this line is through getting the interest and co-operation of the family physician. He has the confidence of his patients and his advice would carry weight.

Of course we feel a little harsh toward the general practitioner when we discover his having fed a patient on aspirin for six months when all said patient needed was a pair of glasses but it is quite likely many of us would do the same thing under the same circumstances. Promulgating this idea of interesting the family physician might result in some of them getting sufficiently interested to acquire the skill necessary to make a complete examination and supplying the glasses. This, however, would not be as serious as it might appear on first thought. Statistics show that about thirty million people needing glasses are as yet unsupplied. The family physician, should he enter the field, would draw largely from the class who would never wear glasses, except as an aid to vision, unless urged to do so by their doctor. The general practitioner, once convinced of harm resulting from refractive errors, would create "eye consciousness" with lots of patients who would eventually go to some one else for glasses, even though the doctor was willing to supply them.

Lots of people dread glasses for various reasons but the more of their friends and neighbors they see wearing them the easier it becomes for them to follow suit. Business begets business and those whom we are wont to call competitors are often in reality co-operators. The average physician is a pretty good fellow who has the best interests of his patients at heart. The only reason he does not suggest glasses more often is because he fails to realize the necessity for them. He has to know so many other things we can hardly expect him to know as much about eyestrain as we who specialize on refraction.

IS VISION ELECTRICAL OR CHEMICAL?

Jno. H. Petty, Opt. D.
Jackson, Miss.

The theory presented herewith, of the Human Eye and the Optic Nerve which connects it, with the sight center of the brain, lying at the rear of the organ of thought.

The study of physiology opens up a whole world of unbelievable magic, yet most of us wander along through our daily lives not paying any particular attention to the various bodily functions and organs. We hear, smell, feel and see, not thinking for a moment as to how we actually do these things. And now as how do we see.

There is this much to say: the image on which the eye is focused is carried into the inner chamber of the eyeball through the iris and the crystalline lens, as our physiologists teach us. Here a most unique phenomenon takes place. The image is carried through the Cornea, the Anterior Chamber, the Lens and the Posterior Chamber and focused upon the Macula, where in a normal eye there is produced a sharp, well-defined image of the subject looked at.

If the function of seeing performed all its operations at this point or juncture, we would naturally see houses, trees and other objects upside down. But here is where part of the great mystery of sight begins, a mystery which some of our greatest physiologists have not as yet unravelled.

The action in the eyeball is only the beginning of sight. The light and shade values of the image cast on the retina fall on a series of what are now supposed to be minute photo-electric cells some 2,000,000 in number. It is now a proven fact that when the various points of light pass through the lens, on to the layer of rods and cones of the retina, extremely minute electric currents are set up and pass along the respective fibers of the 2,000,000 rods or cones to the cells of sight located in the brain, and it is at this point where we interpret the image or picture which the eye beholds and not in the eye itself.

In other words, if one should receive an injury at the top or rear of the head in such a position as to affect the sight portion of the brain, then the functions of sight would also be affected.

The more certain it seems that the whole action of sight is very much akin to that of the man-made electrical eye, in which, as is known, selenium or light-sensitive cells are used.

The electrical theory of ocular-vision in humans as well as in animals has been arrived at in several different ways. The 2,000,000 odd fibers composing the optic nerve and over which the light impulses, either electrical or chemical, but presumably and apparently electrical, are transmitted of very small size, so small that they are only visible under a high power microscope. The microscope shows these covered with a fatty insulating covering which acts to preserve the electrical potential and natural charge of the body.

And now to make matters as explicit as possible.

The eyeball is just one by one and a quarter inches in diameter. The outside coat is known as the selerotic, the second layer is the choroid and the third is the retina. This retina coating covers about five-sixths of the inner wall of the globe. In this retina is located 2,000,000 little capsules and the middle occipital part of the brain are to be found the 2,000,000 brain cells. Now to give you some idea of the working connection between the eye and the brain, take a small thread, say two and one-half inches long, fasten on each end a small bead, and you have a working idea of the connection between the retina and visual centers of the brain. Thus when different graduations of light impinges upon these rods and cones in the retina it causes currents of varying strengths to pass along the more than 2,000,000 fibers comprising the optic nerve to the proper sight cells in the brain, thus energizing them. These 2,000,000 capsules of the retina each contain a fluid of distinct color, and the fellow brain cell a fluid of a similar color. The the eye is focused upon an object each color is then taken up by a like color capsule and conveyed back to the fellow brain cell of like color. But mind you now, the object when conveyed to the macula is upside down, owing to the crossing of the rays of light. The image is conveyed in this condition back to the commissure, here is where the optic nerves cross and it is in this crossing of the fibers the image is set upright and conveyed back to the fellow brain centers in proper posture, and remember that no brain cell responds except those of like color taken up by the capsules in the retina. Hence, there stands in bold relief the picture of the object looked at.

OPTOMETRIC FACTS FOR THE OPHTHALMOLOGIST'S CONSIDERATION

J. I. Kurtz, B. Sc., A. O., F. A. A. O.
Minneapolis, Minn.

From time to time there appear articles in ophthalmological publications pointing out the evil of having optometrists refract eyes and prescribe glasses. The main contentions are: First, that optometrists are not qualified to refract from an educational standpoint, and second, that only men with medical training should be entrusted with the nation's eyesight, in order that "the public may be protected." That these claims are not well founded is well known to many medical and optometric refractionists. The writer feels particularly in a position to refute these statements as being absurd and groundless, because of the fact that during the world war he was connected with the eye department of one of the U. S. base hospitals and had the opportunity to observe the refraction work of a great number of ophthalmologists, and it was astounding to him to find that of the large group of medical refractionists, made up of lieutenants, captains, majors, etc., there were only two men whose refractive findings of a case when recorded would wholly or even partly agree. As for the rest of them, if several officers would refract a certain case, each one of them would have an entirely different set of findings, even though they all used cycloplegics.

This was a great display of lack of knowledge of refraction by those who pretend to be the only ones competent to refract. This was the first opportunity the writer had to get first hand information of conditions which actually existed and still exist now. The other opportunities the writer has had to study and observe the work of others is by getting cases which were formerly cared for by ophthalmologists.

The writer will mention here only a few of the many cases he has on record and point out what was prescribed by the ophthalmologists and what the case actually needed and was given by the writer, which brought the desired result, i. e., relief.

Case 1. Mr. S., aged 16, high school student. Complains of headaches and pain in his eyes when used for near work. The glasses he had were prescribed under cycloplegic, which as he claimed did not help him any, but made conditions worse. His glasses neutralized O.D. — 0.50 D. Cyl. axis 90; O. S. — 0.75 D. Cyl. axis 90. Static and dynamic retinoscopy revealed hypermetropia with a slight hypermetropic astigmatism against the rule. 10$^{\Delta}$ to 12$^{\Delta}$ of esophoria at distance and 14$^{\Delta}$ of esophoria at near. A + 1.00 D. Sph. O.U. was prescribed instead of the minus cylinders. This gave the patient perfect comfort and he was able to go on with his school work.

Case 2. Miss M., age 31, office worker, called for examination November, 1923. Complained of headaches and blind spells. She had to stay away from work during these attacks. She had been under the care of most of the ophthalmologists in her own city, which has a population of one-half million. Her last pair of glasses, which were prescribed by an ophthalmologist of standing (he held the rank of captain in the medical corps during the late war), neutralized O.D. + 1.00 D. Cyl. axis 180; O.S. + 4.00 D. Cyl. axis 135. Visual acuity with and without lenses was O.D. 20/200; O.S. 20/100. The writer's examination revealed the need of O.D. — 10.00 D. S. O.S. — 8.00 D.S. + 4.00 D. Cyl. axis 75. Note the difference in the prescriptions, the former having been given her after the use of a cycloplegic. The glasses prescribed by the writer have been worn with comfort since they were prescribed.

Case 3. Patient S., male, age 56, office executive. Called for examination May, 1925. He complained that eyes felt uncomfortable, especially when used for near work. Was re-

fracted under a cycloplegic by an ophthalmologist four months ago, who prescribed O.D. + 0.50 D. Sph.; O.S. + 0.25 D. Sph. added for near O.D. + 2.50 D. Sph. O.S. +2.25 D. Sph. The writer's examination revealed static retinoscopy O.D. + 1.50 D. Sph. O. S. + 1.25 D. Sph. Dynamic retinoscopy O.D. + 3.50 D. Sph. O.S. + 3.25 D. Sph. 4Δ of esophoria at distance and 6Δ to 10Δ of esophoria at near, also 2Δ of right hypophoria. The static and dynamic retinoscopic findings were prescribed in bifocal form and a 1½Δ prism base up and down equally divided between the two eyes was incorporated. After wearing this prescription for one month the patient reported much relieved of his former symptoms.

Case 4. Mr. A., age 28, school teacher, called for an examination of his eyes September, 1925. Unable to use eyes especially for close work. Had been under the care of an ophthalmologist for a number of years. His latest prescription from an examination under a cycloplegic was O.D. — 1.25 D. Sph. ⌣ — 1.25 D. Cyl. axis 180; O.S. — 2.00 D. Sph. ⌣ — 0.50 D. Cyl. axis 15. The writer's examination revealed:—static retinoscopy O.D. — 0.50 D. Sph. ⌣ — 1.25 D. Cyl. axis 180; O.S. — 1.50 D. Sph. Dynamic retinoscopy O.D. + 3.00 D. Sph.; O.S. + 1.00 D. Sph., also 8Δ of esophoria without any correction, this was increased to 16Δ with the minus correction. Vision without lenses was O.D. 20/100 —, and O.S. 20/200. With O.D. — 1.00 D. Sph. ⌣ — 1.00 D. Cyl. axis 180, vision was 20/20; O.S. — 2.25 D. Sph. ⌣ — 0.50 D. Cyl. axis 15, vision was also 20/20. The patient was under the writer's care for six months. At the last examination he could read the 20/25 line with either eye without any lenses. The esophoria was reduced to 2 degrees.

Case 5. Miss E., age 24, called for examination February, 1924. She complained of eye pains, headaches and dizziness, inability to use eyes for near work. The writer's examination revealed:—static retinoscopy O.D.+0.75 D. Sph.; O.S. + 0.75 D. Cyl. axis 90. Dynamic retinoscopy O.D. + 1.75 D. Sph.; O.S. + 1.00 D. Sph. + 0.75 D. Cyl. axis 90. Visual acuity without lenses O.D. 20/15; O.S. 20/20. She had 20Δ of esophoria and 14Δ of left hypophoria at distance and 30Δ of exophoria and 14Δ of left hypophoria at near. Similar findings were obtained during several other examinations. The patient was given O.D. 6Δ base in ⌣ 3Δ base up; O.S. 6Δ base in ⌣ 3Δ base down. After wearing the glasses for some time in addition to oculo-prism treatments, the patient reported feeling splendid and that all former symptoms complained of had disappeared. The prescription had been reduced several times during a period of one year until it finally read: O.D. 3Δ base in ⌣ 1Δ base up; O.S. 3Δ base in ⌣ 1Δ base down. The patient at the time of the last examination complained of some internal trouble of which no satisfactory diagnosis was arrived at after being examined by no less than nine different medical practitioners. The patient was then advised to undergo a thorough physical examination and the writer recommended her to go to one of the most reputable medical clinics in the country. The advice was followed, and after being thoroughly examined the diagnosticians at this clinic were unable to find the seat of the trouble. During the course of the general examination she was sent to the ophthalmologic department to have her eyes examined. There she was advised that her glasses did not fit her and was given another prescription, which was O.D. — 0.25 D. Sph. ⌣ — 0.25 D. Cyl. axis 180; O.S. + 0.50 D. Sph. ⌣ — 2.00 D. Cyl. axis 170. Upon her return to Minneapolis she called at the writer's office complaining that she was unable to wear the glasses prescribed to her at the clinic and wished to have a pair made up similar to her last prescription. The writer, however, urged her to try and wear the glasses prescribed by the ophthalmologists at the clinic and not to discard them before she had given them a fair trial. She was reasonable and again listened to our advice, but after many weeks of painful trial she had to go back to our compound prismatic prescription, which gave her relief at once.

Case 6. Mrs. A., age 40, called for examination September, 1924. She complained of severe headaches, inability to use eyes at all for near point

work with or without her glasses. Had insomnia for the last 14 months. The glasses she wore at that time were prescribed a year previous by an ophthalmologist, who enjoys a considerable reputation. He was a colonel in the U. S. army medical corps during the world war and has lectured on some occasions at the section of ophthalmology of the American Medical Association and is also a frequent contributor to the national ophthalmological publications. These glasses neutralized O.D. + 0.75 D.S. ⌒ + 1.00 D. Cyl. axis 90; O.S. + 0.75 D.S. ⌒ + 0.75 D. Cyl. axis 90. Add for near O.U. + 1.00 D. Sph. The writer's examination revealed, static retinoscopy, O.D. + 4.00 D. Sph. O.S. + 3.75 D. Sph. Dynamic retinoscopy O.U. + 5.00 D. Sph. The patient was under the writer's care for several months and the final prescription was for the distance and near O.D. + 3.75 D. Sph. O. S. + 3.50 D. Sph. She will no doubt be able to accept, later on, a still stronger plus correction approaching the dynamic findings.

The patient was pleased with the last prescription because she could see well, felt comfortable and could sleep again.

The writer is not describing these cases with the mere idea of contrasting the lack of knowledge of some ophthalmologists with the abundance of knowledge of an optometrist. This is far from being the case. The reason we are bringing up these cases is because it may throw a little more light upon what is actually taking place daily.

It is true, of course, that any ophthalmologist can look through his files and find a number of cases which were improperly refracted by some optometrist, but this will be true only of those optometrists who entered the field some time ago and not of those who entered the field of late since the educational requirements have been materially raised. The cases mentioned here are more striking because of the fact that they do not come from the offices of ordinary ophthalmologists. They come from men with established reputations in their communities as well as in their professional organizations and are looked up to as leaders in their field. If these cases mentioned represent some of the refraction work done by some of the more competent group of the ophthalmologic profession, it would not require much of an imagination to conceive some of the refractive work which is being done by the "two and three months short course specialists." Is the public really safe in entrusting their sight to these men, and what is being done by "the powers that be" to lengthen the "short cut road to specialization" and thereby protect the public interest? What is being done to make it necessary to acquire a proper amount of training before a general practitioner can become an eye, ear, nose and throat specialist and how much time should one be required to spend in training before being considered eligible to practice upon the public any one branch or all of the specialties enumerated. The late Dr. Frank C. Todd, professor of clinical ophthalmology at the University of Minnesota, in a paper read before the section of ophthalmology of the American Medical Association as early as 1902, stated that "A proper training for refractive work alone requires an entire year of continuous study and experience." This statement was made 24 years ago when the science of refraction was in its infancy. In a discussion on the subject with the writer at one of the U. S. army base hospitals during the war Dr. Todd stated that at least two years should be spent on the study of refraction alone, and if he were alive today he would, no doubt, set the requirements still higher. This would exactly coincide with the writer's views. While we do not care to suggest the time which should be required in the preparation for ophthalmology and oto-laryngology (being perfectly content to leave this matter to the group practicing these specialties), *we do maintain that no person can become a competent refractionist by taking a short course in refraction, no matter what other training and degrees that person may possess.*

Optometry like dentistry must be studied by itself as a separate course and not be tagged on as an appendage to some other specialty or group of specialties, or else both the appendage

and the specialty will suffer, to the ultimate disadvantage of the public.

Dentistry has progressed in this country more than in any other country in the world. Why? Because dentistry in America had been kept as an independent profession and was not made an appendage to the medical profession as was the case in most European countries.

Optometry — refraction — likewise will attain the highest point of development only when it will follow the course of dentistry. Optometry is fast establishing four-year courses at various universities and opportunities exist now for anyone who desires to prepare himself to become a specialist in the art of refraction. Some courses being still fairly new, may in some cases not be well rounded out, and in this regard any friendly criticism or suggestion, as to how they may be still further improved, from all those who have the "genuine public welfare at heart" will be welcomed.

It is true that optometry still has some of the oldtimers within its ranks, but this is only a matter of a generation. The medical profession had the same problem to contend with. There are probably even today still a few medical doctors living who "read medicine" in a doctor's office. They, of course, came in before many medical schools existed and before the present medical laws.

With the raising of the educational requirements only those will be admitted to the practice of optometry who are highly qualified and the doors will be closed to the unfit to practice refraction amongst the optometrists. Now we come again to this question, what about the medical profession? What is being done to prevent the unfit to enter the field of refraction? To quote again Professor Todd from a paper on "Higher Preparation in Ophthalmology," there he states in the closing paragraph: "Certainly there must be some means provided that the general practitioner and the layman may be able without payment of his 'pound of flesh' to distinguish a well prepared from an unsafe so-called 'specialist.' Ultimately, but not yet, laws will be enacted to protect the people from pretending specialists, but first we must define what is needed to prepare the specialist and prepare the courses for him to adequately provide himself with proper training."

Optometry has done precisely that. We have defined what is needed to prepare for the refractionists, we have secured laws in all states of the Union to keep out the unfit from practising upon the public. Now will the medical profession co-operate "for the protection of the public" and prevent the unfit from practising refraction under the cover of the medical diploma, which they guardedly admit covers no refraction?

OPTOMETRIC NOTES

INTERPUPILLARY GAUGE

E. O. Fjelstad, Opt. D.
New York, N. Y.

A short time ago Dr. O. L. McCulloch, in an interesting article on the matter of taking the interpupillary distance, mentioned a gauge used for this purpose. Several letters have come to the Journal asking regarding this gauge, where it was made and just what could be accomplished with it.

The gauge is made by the Bausch & Lomb Company and, to quote from their bulletin, is designed "for measuring the distance between the pupils when vision is directed upon distant or near objects.

"The peculiar advantage of the instrument is that it measures the distance of either pupil from the center of the bridge of the nose and thus takes into account the almost universally existing asymmetry of the eyes with respect to that point. In this way a most important measurement is obtained for the accurate adjustment of a spectacle frame.

"The measurement involves no setting of a scale, and in the majority of cases a single reading suffices to furnish the required information."

THE-ODOR-AH!

Charles P. Cleaves, Opt. D.
Center Harbor, N. H.

Patient: "The bifocals served well at the start. But when summer was over and fall work began, with the sewing for the children my headaches returned. There's a pain now in the upper part of the left eye."

Optometrist (after examination): "The lenses apparently fit perfectly. You have a short-sighted astigmatism—oblique. Bifocals are sometimes unsuitable for such cases. The centering of the eyes upon the center of the reading portion was not exact, so I have set the left lens outward. But if you wish I will supply single lenses for reading. How many hours a day of near work?"

P. "About four."

O. "Regularly?"

P. "O, no! Sometimes I do no near work or reading for a few days, then it all comes in a bunch."

O. "Do about the same amount of near work daily. Keep the eyes in order by regularity. What lamps do you use—electric?"

P. "No, daylight chiefly. I can't work much nights. I'm always tired. We have only kerosene. But I have a well-shaded lamp."

O. "In the midst of a sea of gloom. Light the room about you by one or two other unshaded lamps. An average of four hours is enough near-work with housekeeping for a family of seven. Well, the transilluminator shows the left maxillary sinus is opaque. Look in the glass."

P. "Yes. Quite a difference."

O. "Fortunately you have artificial teeth. That relieves you of suspicion so far as present focal infection about the teeth is concerned. But that and bifocals at forty years indicates the early cause. Is any indication of an infected sinus known to you?"

P. "No, sir."

O. "Any droppings in the throat?"

P. "No more than usual."

O. "Any discharge from the nose?"

P. "Nothing but a little catarrh."

O. "Equally from each nostril?"

P. "No, more from the left. It smells. But they—"

O. "You've told your story!"

P. "But they always told me it was nothing but catarrh."

O. "Call it catarrh—or purulent mucus. A rose by any other name would smell as significantly. Let's call it The-odor-ah! Down there in the maxillary sinus, hidden from eye or instrument, it rises from once unknown sources, like the river Nile. But its overflow is higher than a garret window, hence the odor. The four-footed beast thrived well with his facial anatomy. But when man stood erect—then his troubles began. And he blamed the serpent—his ancestor! I'll send you to a surgeon."

P. "How much will it cost?"

ABSTRACT DEPARTMENT

Optometric and ophthalmic Journal articles and reprints to be abstracted should be sent to Dr. G. L. DuPlessis, 209 Yeates Building, Minneapolis, Minnesota. Only papers of interest to optometrists will be reviewed in this department.

Modifications of Relief Produced by Decentration in Binocular Vision. Dupuy-Dutemps, from the Society proceedings of the Societe Francaise d'Ophthalmologie. Paris, May, 1926.

A plane surface seen through convex spheres or cylinders axis 90°, decentered out, appears concave. It appears convex if the lenses are decentered in. This same distortion is inversely produced by concave spheres or cylinders. This phenomenon as previously explained by the author is due to the prismatic action of the lenses and is evident only in binocular vision.

The same phenomenon is observable with prisms and the direction of curvature of a straight line seen through these will depend on the positions of the bases. This aberration has been calculated with Cornue's (1872) general formula. The author resumes these facts as the first step in the study of the physiological phenomenon of stereoscopy. These facts find a practical application in the selection and the adaptation of optical lenses.

G. L. Du P.

A Stereoscopic Phenomenon, from the Society proceedings of the Societe d'Ophthalmologie. Paris, May, 1926.

The experiment is performed in the following manner: Two rods are situated in the same plane before an evenly illuminated background. One rod is given a to-and-fro movement in that horizontal plane, while the other remains fixed. Upon observing these rods with both eyes, one wide open and the other obscured by a smoked glass with an apperture smaller than the pupil, the moving rod seems to leave the plane and to turn around the fixed rod. This phenomenon is due to the time lost between excitation and perception not being the same for the clear eye and the obscured eye. On this principle, Pulfrich designed various photometric apparatus.

G. L. Du P.

Monocular Malingering Test. E. H. Schild, American Journal of Ophthalmology, pp. 471, Nov., 1926.

Dr. Schild suggests a method for testing malingerers by using a combination prism and plate of glass, with parallel sides, which are so combined that either can be held before the claimant's good eye and changed without his knowledge. When skilfully used will reveal any false claim to monocular blindness and can be made to show how much vision the alleged blind eye really has.

The prism plate consists of a small rectangular piece of glass about 1x2 inches, one-half of which is rather thick plano and near the middle line tapers off to a prism of 5$^{\Delta}$ to the other half. This prism plate can be used in three positions: (1) As a plano, by holding the plate so that the dividing line is just above the pupil. (2) As a double prism—by lowering the dividing line to come midway across the pupil. (3) As a single prism base down by lowering the dividing line beyond the lower edge of the pupil.

The important part of test is the shifting of positions from 1 to 3. This must be done at a moment when the subject has both eyes open and his attention is fixed on the test chart so that he will not notice the change.

If the man to be examined claims that the sight of the left eye is poor as a result of some trivial injury and there are no visible signs to indicate the degree of damage, the right eye being normal, the glass is to be held in front of this eye in position one. The claimant is to look at a test chart with only one line of type exposed and he should be asked how many lines of type he sees. He should under all circumstances see only one. Now the glass is to be moved to position two. He should now see two lines of type with the right eye regardless of the condition of the left eye, as the double prism produces diplopia in the right eye. If the left eye is actually good its image will fuse with the lower of the two seen by the right eye. When asked how many images he sees he will reply two. This question is to be repeated and at the same time shifting the glass to position three being careful not to let him notice the change. If the left eye is actually blind he will see only one image. If he sees two it shows that the left eye is not blind, because one of the two images is seen by that eye.

To test the exact amount of visual acuity in the left eye have him read the lower line of type which belongs to the left eye. The smallest type he can read measures the acuity of that eye.

J. I. K.

Measuring the Abnormalities of the Fundus. P. Bretagne. Annales d'Oculistique (French). March, 1926.

The author conceived the idea to incorporate to the magnifying lens used in indirect ophthalmoscopy, a micrometric scale, for the measurement of abnormalities and features of the fundus. This is done by engraving on the glass a scale divided in millimeters, a little outside of the center so as not to obstruct vision. This scale is not so much intended for actual measurements as for comparative measurements with the other eye.

G. L. Du P.

THE AMERICAN JOURNAL OF OPTOMETRY

Vol. 4 JANUARY, 1927 No. 1

CAREL C. KOCH, EDITOR
209 Yeates Building, Minneapolis, Minn.

J. I. Kurtz, Associate Editor
209 Yeates Building, Minneapolis, Minn.

E. O. Fjelstad, Associate Editor
22 E. 38th St., New York, N. Y.

Published monthly as the organ of the Delaware, Iowa, Maryland, Minnesota, Nebraska, North Dakota, Oklahoma and Vermont Optometric Associations.

Original papers, scientific communications and correspondence should be addressed to the Editor. Books for review should be sent to Dr. E. O. Fjelstad. Clinical Reports and Society Proceedings should be sent to Dr. J. I. Kurtz. Practical Notes and Current Refractive Topics should be addressed to Dr. R. M. Peckham, Waterbury, Conn.

Annual Subscription Two Dollars in Advance. Single Copies 20c.

Copy of advertisements must be sent to Dr. Jack I. Kurtz by the tenth of the month preceding their appearance. Subscriptions, applications for single copies, communications with reference to advertising or other business, should be addressed to the Business Manager,

DR. JACK I. KURTZ, Room 209 Yeates Building, Minneapolis, Minnesota.

The Journal has no objection to the reprinting by other magazines of any of its articles, provided such reprints are properly credited to the American Journal of Optometry.

LICENSING AUTOMOBILE DRIVERS

For the last few years a movement has been developing for the licensing of automobile drivers. Optometrists in some states have done their share to awaken public officials and civic bodies to the importance of good eyesight and its relation to safe driving, and have advocated the passage of proper legislation which will make it compulsory for all drivers of motor cars to be licensed and that a minimum visual requirement be set up which each applicant for a license must possess. The minimum visual requirement is a very important matter from the standpoint of safety and should be incorporated in each state automobile law, which aims to safeguard the life of its citizens. It is gratifying to note that in most places optometrists have done their share to bring to the public's attention the importance of this new legislation which will tend to reduce the ever increasing number of automobile accidents. There was at first a considerable amount of opposition to such legislation from city to state automobile clubs, civic and commerce associations and public officials in general. As time passed on the consistent and persistent agitation and education for the passage of safety legislation was continually carried on, with the result that those who were the bitterest opponents before are now not only favoring it but are systematically organizing, to bring about the enactment of such legislation.

For instance during the middle of October a State Safety Conference was held in the state of Minnesota. The gathering was made up of representatives of the League of Municipalities, traffic officers, judges, county attorneys, civic and commerce associations and city and state automobile clubs. This conference has gone on record unanimously advocating the licensing of automobile drivers, and is now framing a bill to be presented at the present session of the legislature. Now, when organizations like those mentioned take the matter of safety legislation in hand optometrists must not stop their activity and be content with the fact that they have been the pioneers in this movement, but should with all the power at their command bring to the attention of these organizations the relation of good eyesight and safe driving and see to it that the proposed legislation has a minimum

visual acuity requirement for auto drivers. No one appreciates the importance of this provision more than the optometrists and it is the duty of each individual optometrist and as well as of the state association to bring this point to the attention of the various organizations which are fostering safety traffic legislation.

There is a certain amount of information and data available on the subject. The A. O. A. has a standing committee making a study of this important work. Dr. Edwin Silver of Washington, D. C., is chairman of the committee, also the Eyesight Survey and Service Corporation of Rochester, New York, has some important material which should be in the hands of all those interested and these agencies will, no doubt, be pleased to cooperate with any optometric organization seeking information on this subject.

Safety conferences will be held in a number of states and safety legislation will be introduced in a number of legislatures. Optometrists are urged to be alert and see to it that a minimum visual acuity be made a requirement for the granting of automobile license.

J. I. K.

ON DISPENSING

The writer has noted of late a tendency on the part of some optometrists to send their patients with their prescriptions to the optical supply houses, the idea being to eliminate the trouble and bother of their having to adjust frames, as well as to fit them. This we believe to be a poor policy, and one which should be avoided by all those who have the interests of their patients and of optometry at heart. We believe that those optometrists who do none of their own laboratory work should have the finished material returned to them and that they should do the adjusting and the final inspecting themselves. The advantages in so doing are threefold. First, the optometrist is bound to be more painstaking and particular than the adjuster at the fitting table of the dispenser. This is naturally true inasmuch as the optometrist well knows that the succes or failure of his work in a large measure rests with the fit and comfort with which the glasses can be worn. Secondly, it seems to the writer to be much better psychology to complete the work in the office in which it was started, inasmuch as the patient is sure to feel that your interest in his or her welfare is greater and more far-reaching if such a plan is carried out. And third, we believe it to be a poor practice to refer these cases to the optical supply house because by so doing you at once enter into a fee-splitting transaction, which is something that all professional men should avoid. To be sure, the practice of fee-splitting is rampant among medical men, particularly among ophthalmologists and their supply houses, but surely this is no reason for us to imitate others. Optometry made considerable advancement in the past and will progress still more in the future if it will not adopt questionable practices. It behooves us not to enter into any financial alliances with others.

C. C. K.

CORRESPONDENCE

Dec. 8, 1926.

Editor, American Journal
of Optometry:

Permit me a few words of comment on Dr. Leventhal's recent article in a contemporary magazine criticizing a previous article by Dr. Barker of England. Dr. Leventhal's critical analysis was very gratifying in that it showed some of our brethren are reading our publications with intelligence and seriousness. But it was painful indeed to see such vehement criticism against a brother overseas when there is so much more to do at home.

The doctrine of monocular ductions, for instance, has been taught for years by many of our own leading lights, including college professors and high-priced lecturers for whose work Dr Leventhal helped pay. Yet I do not recall ever having read any criticism by Dr. Leventhal, even very mild criticism, against such teachings. Should not criticism, like charity, begin at home?

What is equally striking is that Dr. Leventhal regards the errors he finds in Dr. Barker's article as especially reprehensible because Dr. Barker is

the president of the British optometrists. As a matter of fact this should act as a strongly extenuating circumstance. Let us look nearer home. In the early years of our organization as a profession the leading officers were usually men renowned for scientific attainments. Then we had for presidents men like Prentice, Eberhardt and Cross, men of outstanding scientific accomplishments. This policy was in line with the policy pursued by other professional organizations where the leading officers are usually the most outstanding scientific men in the profession.

However, it seems that under such leadership, optometry did not make the progress in organization, legislation and publicity that was necessary to put the profession on the map. It was found that optometry differed from the other professions and needed men of a different type at the helm. Accordingly the men later chosen to head our organizations were men noted for their organizing and executive ability and not for any special scientific attainments. Our chief national and state officers even now, I believe, do not lay any claim to outstanding scientific accomplishments or contributions. They have advanced us to the enviable position we occupy now because of their organizing and executive ability, and this is all we expect from them. Why, then, should we expect it otherwise from our British brethren and condemn them for doing what we have found best in our own country? Does it not ill behoove us to ignore the beam in our own eye and point at the mote in the other's eye?

Joseph I. Pascal,
6 W. 98th St.,
New York City.

SPECIAL REPORTS

THE PROBLEMS OF OPTOMETRY

William Smith, Opt. D.
Roxbury, Mass.

Much has occurred in Optometry these past few weeks to set the more devout among us athinking. For instance, our colleagues in New York have now come to the realization that they have been over zealous in their efforts to please the medical profession. We have reference in particular to the Optometric Education and the Doctorate Bills.

We are reminded of a very nice fable by Aesop, which he calls, "Lion In Love."

"It happened in the days of old that a lion fell in love with a woodman's daughter; and had the folly to ask her of her father in marriage. The woodman was not much pleased with the offer, and declined the honor of so dangerous an alliance. But upon the lion threatening him with his royal displeasure, the poor man, seeing that so formidable a creature was not to be denied, hit at length upon this expedient: 'I feel greatly flattered,' said he, 'with your proposal; but, noble sir, what great teeth you have got! And what great claws you have got! Where is the damsel that would not be frightened at such weapons as these? You must have your teeth drawn and your claws pared before you can be a suitable bridegroom for my daughter.' The lion straightway submitted (for what will not a body do for love?) and then called upon the father to accept him as a son-in-law. But the woodman, no longer afraid of the tamed and disarmed bully, seized a stout cudgel and drove the unreasonable suitor from his door."

Medicine realizes that Optometry's strength depends upon posterity, and its prestige upon doctorial recognition, so "it hit upon this expedient" and Optometry is a "willing victim," as it were.

It is an age-old story, Optometry's folly is medicine's gain. Instead of spending six years at an Optometry school, one can become a Medical Doctor and practice Optometry, without taking a special State Board examination to do it, in the same length of time. One will then have all the rights and privileges and will not have to sign affidavits relinquishing his rights to his hard earned Doctorate degree, because that degree was awarded him "after January 1st, 1917." Also, a degree from any recognized medical school will do. Tufts medical school, a "grade A medical school," recognized by the Board of Regents of New York, and in every state and territory, requires only two years of pre-medical education in addition to the four-year regular medical course. This is only one of many examples as far as medical schools are concerned. Then why should one study Optometry for six years, when he can become a physician in the same length of time.

Wouldn't it seem rather queer? Educational requirements raised to such a level, at the same time jewelry stores selling eyeglasses over the counter the same way as rings, bracelets and other trinkets of feminine adornment. Or, one can buy for the small sum of $3.75 a pair of glasses that have traveled all the way from Chicago, "Satisfaction positively guaranteed or money refunded."

We also read that the Osteopaths and Chiropractors in Illinois will attempt to amend the Optometry law of that state whereby they would become exempted. We are compelled to admit ignorance. Will some kind reader, familiar with Osteopathy, Chiropractics, and the other schools of drugless healing, kindly inform us just what vertibrae would have to be manipulated to correct a condition such as this: O. D. —1.75 D. Sph. ⊃ —0.37. D. Cyl. Axis 175 ⊃ ½ Δ prism base up. O. S. —0.75 D. Sph. ⊃ —0.62. D. Cyl. Axis 90.

It is about time that Optometry took some definite action to stop once and for all this nonsensical nuisance. Optometry has become a "free for all," so to speak, and every Tom, Dick and Harry, takes a fling at it every now and then. The gentlemen who so willingly passed these two provisions to the Optometry Law in New York could have done Optometry a great favor by providing for the elimination of SUCH NUISANCE.

The Dentists acted most wisely. They saw to it that no one infringed on their rights By Providing Such Amendments to the Dentistry Laws That Would Keep Non-Competents Out. The average physician knows less about Optometry than he does about Dentistry (and he knows nothing about the latter). He is permitted by law to practice Optometry, but he is kept out of Dentistry.

We are fully in accord with Dr. Charles M. Scherer, in that we need more Optometric Research. First, we need Optometric Research, then, we need more Optometric Research.

By the way, would any one kindly suggest where we could do this Optometric Research? We have no Infirmaries. Our schools are doing very little or no research at all. Wouldn't it be rather wise for us, in a way of experiment, to Create One Infirmary for the Profession, to be maintained by the entire profession. Let this infirmary be of twofold service; first, a means of serving people; second, of research value to Optometry. We will find it a profitable experiment. We hate to prophecy, but we feel certain that this will be the beginning of a new era in Optometry. It would raise the profession to the same standard as the other branches in medicine, and would give it the proper prestige. Above all, This Will Be Our Experimental Laboratory, where all research could be carried on with much benefit to Optometry.

We are also in accord with Dr. Samuel H. Robinson of Prescott, Arizona, who suggests an enlargement of the field of Optometry so as to include ocular therapeutics in their present work. A four year course in Optometry would fully prepare one to do this work. A medical degree is no more needed than it is in Dentistry. An Optometrist of the new school is quite well familiar with the action and uses of the cycloplegic and mydriatic drugs and Ophthalmology, but is denied the privilege of putting his knowledge into practical use. A four year course in Optometry to include a thorough course in Materia Medica, and Pharmacology, would make the

Optometrist capable of handling pathological conditions of the eyes. We must strive, however, to become better Optometrists, and do all we can to broaden our knowledge. We are entrusted with a sacred task, and it is our duty to perform it most devoutedly.

We must also strive to attain better understanding between Optometry and Medicine. Let us not forget that we both aim to do the same service to humanity—relieve suffering, each in our ways and means. Both could benefit by this.

We have on our records cases which we corrected after we had the patient seek medical attention through our diagnosis. Cases which were diagnosed by physicians as something different than optical defects. Also, cases which were diagnosed by us, recommended for medical treatment, and then referred back to us for refraction. Some broadminded physicians realize the importance of the optometrists in their branch of human service and work in conjunction with them. But their number is small. Ethical Optometry is our only salvation. Our future depends on the Optometrist of the new school.

REPORTS AND ANNOUNCEMENTS OF SOCIETIES

STATE EDITORS

E. B. ALEXANDER, Oklahoma
A. S. ANDERSON, North Dakota
J. F. ANDREAE, Maryland
L. P. FOLSOM, Vermont
D. A. KINNEY, Iowa
J. A. LARGE, Minnesota
C. A. PERRIGO, Nebraska
M. B. MEYER, Delaware

Reports of Society Proceedings in Delaware should be sent to Dr. M. Burton Meyer, 101 West Eighth St., Wilmington; in Iowa to Dr. D. A. Kinney, Charles City; in Maryland to Dr. J. F. Andreae, Baltimore; in Minnesota to Dr. J. A. Large, Winona; in Nebraska to Dr. C. A. Perrigo, Freemont; in North Dakota to Dr. A. S. Anderson, Williston; in Oklahoma to Dr. E. B. Alexander, Duncan, and in Vermont to Dr. L. P. Folsom, So. Royalton.

MINNESOTA ASSOCIATION MEETING

The semi-annual meeting of the Minnesota State Association was held on Tuesday, December 28, at the Odin Club, Minneapolis.

Dr. J. I. Kurtz, secretary of the association, announced the convention committees appointed by the president. They are as follows: Arrangements and Educational Committees (combined), Drs. A. O. Norstrom, chairman; C. C. Koch, C. P. Nelson, all of Minneapolis; Earl Jones, St. Paul; A. Skogg, Duluth. Publicity Committee, Drs. C. P. Sneider, Minneapolis, chairman; A. Fandel, St. Paul; A. Rudolph Burquist, Duluth. Nominating Committee, Drs. J. E. Peterson, Minneapolis, chairman; W. W. Arms, Owatonna; G. H. Goodwin, Marshall. Auditing Committee, Drs. H. Christianson, St. Paul, chairman; Jos. Christopherson, Virginia; H. Bandel, Spring Valley.

The annual convention of the association will be held February 14 and 15 at the Radisson Hotel, Minneapolis. The committee is planning very elaborate educational and entertainment programs.

OKLAHOMA ASSOCIATION

A meeting of the Board of Directors of the Oklahoma Association of Optometrists was held at the Huckins Hotel, Oklahoma City, Sunday, December 5th.

Those present were President, Dr. H. S. Hannis, Tulsa; First Vice-president, Dr. J. A. Clay, Durant; Executive Committee, Drs. W. S. Farmer, Oklahoma City; W. K. Grady, Stillwater; and V. E. Bowers, Lawton; Secretary of the Board of Examiners, Dr. Frank H. Robertson, Blackwell; Chairman of the Legislative Committee, Dr. G. T. McVey, Oklahoma City; and the Secretary-Treasurer, Dr. E. B. Alexander, Duncan.

Dr. G. T. McVey, Chairman of the Legislative Committee, Dr. W. S. Farmer, Chairman of the Educational Committee, Dr. V. E. Bowers, Chairman of the Law Enforcement Committee, Dr. J. A. Clay, Chairman of the Publicity Committee, gave a report of the activities of their various committees.

Arrangements were completed for a postgraduate clinic conducted by Dr. R. M. Peckham, to be held at the Mayo Hotel, Tulsa, January 17th and 18th. Dr. W. S. Farmer will be in charge of the program and Dr. H. S. Hannis will be in charge of the local arrangements.

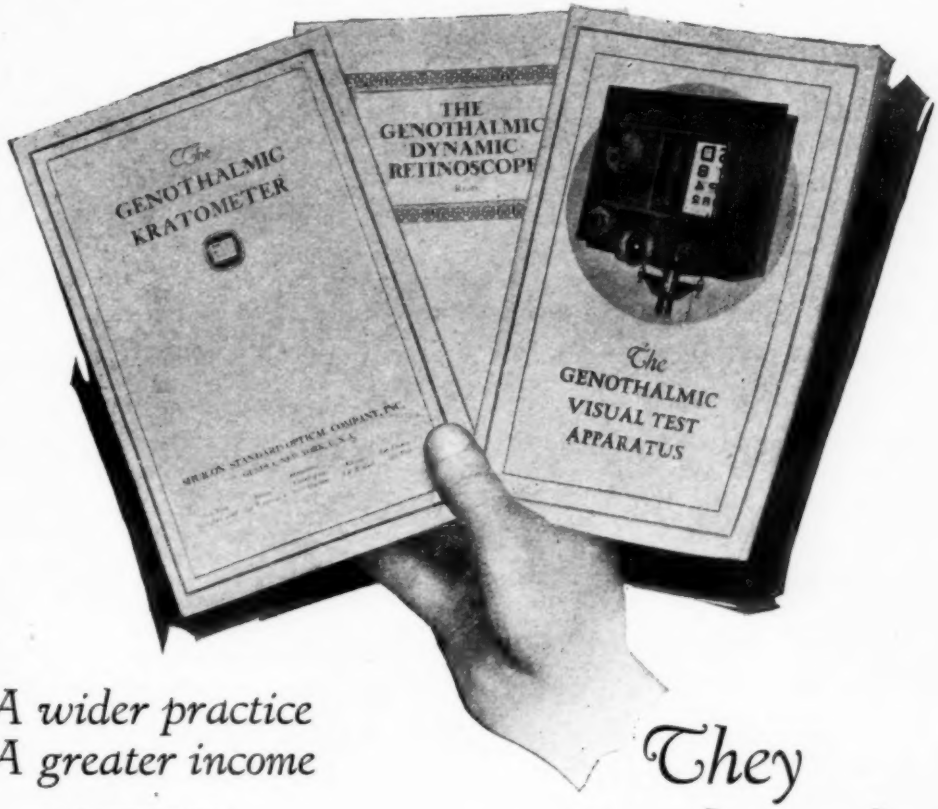
Plans were made to take care of optometry's interests at the next session of the state legislature, which meets in January.

E. B. ALEXANDER, Opt. D.,
Secretary.

SKEFFINGTON'S CLINICS AND LECTURE CLASSES

Doctor A. M. Skeffington's winter itinerary of clinics is completely filled, we understand, and societies wishing to put on a week or ten days of intensive work in the late spring should get in touch with him at once as dates are being filled rapidly. This is one of the most successful lecture seasons he has had and the men attending his talks are very enthusiastic. This Journal has received several letters from optometrists in various states explaining that the men have voted to have him again next year.

There are IDEAS *in these books*



A wider practice
A greater income

PRESTIGE
PRIDE
SATISFACTION

THESE are the things many men have secured through Genothalmic Instrumentation. These instruments have opened the way to professional achievement and the rich rewards which follow prestige and authority.

YOU HAVE
THE SAME OPPORTUNITY
SEND FOR
THESE BOOKS TODAY

They are worth reading

SEND
FOR YOUR
COPIES
TODAY

SHUR-ON STANDARD OPT. CO., Inc
GENEVA, N. Y.

Gentlemen:
Please send me by return mail, free of charge the books I have checked below:

- ☐ VISUAL TEST APPARATUS
- ☐ KRATOMETER
- ☐ DYNAMIC RETINOSCOPE

Name_____

Address_____

_____

Say, I saw it in the American Journal of Optometry